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RESEARCH ARTICLE

Trends in broiler chicken meat production and food security in the sulaymaniyah governorate, Iraq

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ABSTRACT

This study aims to report the trends in chicken meat production, importing, and per capita consumption in the Sulaymaniyah governorate, as well as, identify the challenges and opportunities of poultry sector development to become a substantial contributor to food security and poverty alleviation in the Kurdistan Region of Iraq (KRI). This study reviews ten years of data on the production of broiler chicken and per capita consumption patterns from 2011 to 2020, in the Sulaymaniyah governorate in KRI. The data from this study explain that more than half of the broiler chicken production projects are located in the Sulaymaniyah governorate. Thus, the growing number of poultry projects has significantly contributed to increasing local broiler chicken meat production by 6 folds and achieving 85.44% of self-sufficiency in broiler chicken meat production, even though their productivity is lower than their production capacity due to the high rate of broiler chicken mortality and uncertain supply chain management. Furthermore, frequent fluctuations and instability in the production rates are observed during the last decade, as broiler chicken meat production increased from 1,669.77 tonnes in 2011 to 20,034.06 tonne in 2015, then dropped to 11,802.36 tonnes in 2016 then rose again to 23,816.13 tonnes in 2019 and then declined again to 11,352.23 tonnes in 2020. These fluctuations and instabilities in local production may harm agri-food production sustainability and food security in the KRI in general, and, the Sulaymaniyah governorate in particular.

Keywords: Poultry; Broiler chicken meat; Meat consumption; Food security; Sulaymaniyah; Kurdistan Region

INTRODUCTION

The growing demand for meat as a protein source in consumer diets is mostly linked to urban growth, change in living standards, diet, and prices. As, quality poultry meat products, especially broiler chicken meat, are available at affordable prices, it is highly consumed in the world (Kralik, et. al., 2018; Valceschini, 2006; Mead, 2004), and the per capita poultry meat consumption is predicted to increase, especially in developing countries, in the next decade (OECD/FAO, 2020).

The people of Iraq and the KRI have always valued eating meat as an esteemed social activity imparting to health and well-being, hence meat production is considered crucial in Iraq and the KRI's agricultural economy. Meat, either chicken meat or red meat, is primarily consumed and commonly used ingredients in Kurdish cuisine recipes (Barzinji, 2015). Additionally, meat is a nutritious, favoured, and available food item that provides high-quality protein, minerals, vitamins, and the needed micronutrients for living a healthy life (Ahmed et al., 2018; Williams, 2007; Sansoucy, 1995).

According to Spencer (2010), poultry meat consumption has noticeably increased in Iraq and the KRI in the last two decades. Accordingly, the increase in poultry meat demand has started after the economy boomed in the region after 2003, which left a big gap between demand and local agricultural production and led to an increase in food imports from abroad (World Bank, 2019). According to Abdallaa et al., (2021) meat consumption, in the KRI, is positively influenced by the growth in household income.

The poultry sector has a vital potency and a significant contribution to the economic development of the KRI (USAID, 2008). Mainly, the poultry industry products and by-products are meat, eggs, and feather in the KRI. According to KRSO (2021), the Sulaymaniyah governorate has the biggest share in poultry farms in the region.

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Regarding previous scientific research studies and reviews on the trends of meat production specifically in the KRI and Sulaymaniyah governorate, only one study has addressed this topic; Neima and Hassan (2020) studied the livestock production tendency in the Sulaymaniyah governorate. Additionally, there are important findings from some other studies regarding consumer choice and preference (Neima, et al., 2021), and the drivers of meat consumption (Abdalla, et al., 2021) in the KRI. Additionally, Dhaghir et al., (2020) showed chicken meat production in their study on the Middle East and North African countries including Iraq.

The objectives of this study are to highlight the trends and major changes in the production of broiler chicken and per-capita-consumption patterns over ten years (2011 to 2020) in Sulaymaniyah governorate, as well as identify the challenges and opportunities to further development in the poultry production industry and food security in the KRI.

MATERIALS AND METHODS

Study area

The study was conducted in the Sulaymaniyah governorate, where is a mountainous area located in the KRI, north-east of Iraq (See Fig. 1). Sulaymaniyah has a hot dry summer and a rainy cold winter climate. Sulaymaniyah governorate's total area is about 1,844,884 hectares, with 607,972 ha of arable lands. It hosts the two major fertile plains in the region (namely, Sharazur and Bitwen plains), and has abundant water resources (Slemani.gov.krd, 2019; and NCCIraq, 2015). This can give it a great capacity for agricultural production and self-sufficiency in agri-food products in the future if the resources are properly and sustainably utilized.

Data collection

The data on the broiler chicken meat production in the Sulaymaniyah governorate were obtained from the General Directorate of Veterinary in Sulaymaniyah governorate (GDVS), the Ministry of Agriculture and Water Resources of the Kurdistan Regional Government (MOAWR-KRG), and the Kurdistan Region Statistical Office (KRSO). Additionally, the data on the human population size were collected from Sulaymaniyah Governorate Office and KRSO.

Data analysis and calculation

The collected data were analyzed with Microsoft Office Excel 2019. In this study, five indicators were used to determine the potential of broiler chicken meat supply, production, and consumption trends, namely; Growth Percentage (%), Growth Rate (GR), Average of Annual Growth Rate (AAGR), Mortality (%), and Self-Sufficiency Ratio (%).

Fig 1. Sulaymaniyah governorate map (Source: Google Map).

The growth percentage (Growth %) was calculated from the value of chicken meat supply at the end of the period of study minus the value of chicken meat supplied at the start point of this study to the value of chicken meat supply at the end of the period of study, multiply 100. Change percentage can be calculated from the following equation (UNESCAPE, 2015):

$$\text{Change } \% = \left(\frac{\text{Ending Value - Beginning Value}}{\text{Beginning Value}} \right) \times 100$$

Where:
Change % = Change percentage between the start and end periods

The growth rate (GR) was calculated from the value of chicken meat production at the end of the period of study to the value of chicken meat production at the start point of this study, multiply 100. GR was calculated from the following equation (UNESCAPE, 2015):

$$\text{GR} = \left(\frac{\text{Ending Value}}{\text{Beginning Value}} - 1 \right) \times 100$$

Where:
GR = Growth Rate

The average annual growth rate (AAGR) was calculated by measuring the average growth rates over several equal lengths of periods on an annualized basis (years).

AAGR was calculated from the following equation (UNESCAPE, 2015):

$$AAGR = \frac{\sum GRn}{N}$$

Where:
AAGR = Average of annual growth rate
GR_n = Growth rate in a period (e.g. year 1, year 2, etc.)
N = Number of Years

The mortality ratio (%) was calculated from totaling the death of chickens during the production period to the number of chicks present in the house from the start. The mortality ratio was calculated from the following equation including the culled birds (European Commission, 2005):

$$\text{Mortality } \% = \left(\frac{\text{Totaling the Death}}{\text{Number of introduced chicks in the house}} \right) \times 100$$

The self-sufficiency ratio (%) was calculated by totaling the amounts of produced local broiler chicken meat during a period to the total supply of chicken meat during that period. The self-sufficiency ratio (%) was calculated from the following equation adopted by FAO (Sassi, 2018):

$$\text{Self - sufficiency } \% = \left(\frac{\text{Total of the produced local broiler chicken meat}}{\text{Total supply}} \right) \times 100$$

RESULTS AND DISCUSSION

Importance of the poultry industry

The poultry sector has significant potential and contribution to the KRI's food security achievement and agricultural economic development. Broiler chicken farms and domestic Kurdish poultry products (which are mainly meat, eggs, feather, and litter) have an important contribution to improving the income of rural households and are profitable for farmers (Herrero et al., 2013).

Since 2009, the Kurdistan Regional Government (KRG) - Ministry of Planning had set a future-oriented vision as an objective for rebuilding the infrastructure of the KRI, in this plan more attention had been given to the development of the agricultural industry and more specifically meat production industry (KRG, 2009; KRG, 2013). The increasing demand of people for meat may play a significant role in fostering the growth of large-scale and small-scale poultry production, sustainably, in the Sulaymaniyah governorate. Currently, the Sulaymaniyah governorate has the biggest share of poultry farms in the KRI (KRSO, 2021). As the growth of poultry production has also led to the feed production plants installation and growing demand for field crops production as maize and soya beans with the increase of job opportunities in the region.

The trends of human population growth and chicken meat supply

Table 1 shows that the human population and broiler chicken meat supply have increased in the Sulaymaniyah governorate during the last ten years (2011 - 2020) at different percentage rates. The human population has grown by 30.501% between 2011 to 2020, meanwhile, the change in the available broiler chicken meat has also increased noticeably. Locally produced broiler chicken meat has a six-fold increased (579.868%), and processed chicken meat increased by 56.213%, while imported frozen chicken meat has decreased by 89.719% between 2011 to 2020. Those data show major growth in domestic broiler chicken production inside KRI.

Overall, the total supply of broiler chicken in Sulaymaniyah governorate markets is not significantly changed with a growth rate of 3.52% in 2020 in comparison to 2011 while the average annual growth rate is equal to -6.70% due to the abrupt decline in chicken meat supply either imported or produced locally in 2016 and 2020 (Fig. 1). Substantial changes are observed in the increase of local products and decline of imports that significantly contribute to food security achievement in the region regarding chicken meat as a vital part of people's diet in this governorate.

The average annual growth rate AAGR for the human population was increased by 2.99, while for total supplied broiler chicken meat decreased by -6.70. The important changes were an increase in AAGR of local production by (32.37) and an AAGR decrease in total imports by (-25.95). The total imports mainly divided on frozen and processed chicken meats that AAGR decreased by (-37.68, and –51.69) respectively. The change percentages rates for human population growth, locally produced chicken meat, imported frozen chicken meat, imported processed chicken meat, and total chicken meat from 2011 to 2020 were 30.50%, 579.87%, -89.72%, 56.21%, and 3.52% respectively, whereas several fluctuations happened between these years. This data proves that, though obvious instabilities and fluctuations were seen in the chicken meat supply, the growth of local broiler chicken production was at a faster pace (from 1,669.77 to 11,352.23 tonne/year) to

fill the gap between chicken meat demands and the human population with a vital decline of chicken meat import (from 11,164.82 to 1,934.34 tonnes) in the Sulaymaniyah governorate between 2011 and 2020. Broiler chicken production was grown sharply between 2011 to 2015 with a sudden decline in 2016 and steady regrowth until 2018 with a sudden peak in 2019 and a sharp decline in 2020 (Fig. 2). These fluctuations in local production are mainly related to political instability and economic crises in this region that cause disturbance in the supply chain because most of the supplies such as feed, vet medicals, etc. are imported from elsewhere. These fluctuations in local production damage the sustainability of agri-food products in the KRI generally and, in particular, the Sulaymaniyah governorate.

The industry of broiler chicken production

Table 2 illustrates the trends of the broiler chicken meat production sector in the Sulaymaniyah Governorate. The number of registered broiler chicken farms has increased by 03.17% from 315 farms with a capacity of producing 4,019,059 broiler chickens but were only able to produce 725,898 broiler chickens out of 1,003,535 chicks in 2011 to 640 farms with a capacity of producing 10,045,955 broiler chickens while only 7,189,503 chickens were produced out of 10,548,430 chicks in 2020.

Overall, there was a steady growth in the number of broiler chicken farms with relatively high capacity that were supposed to be able to supply enough chicken meat for the Sulaymaniyah city population but the mortality percentages of the chicks introduced to the poultry farm is dramatically high, ranged between 18.14% to 56.39%, that is fluctuated from a year to another between 2011 to 2020 (Fig. 3). According to the officials, the high mortality rates is mostly related to chicken diseases outbreak, mainly Newcastle disease (GDVS, 2021). The detailed reasons for the high mortality rate and other constraints of chicken meat production are needed to be investigated to determine the challenges and opportunities for improving the productivity and sustainability of the poultry farm projects in the Sulaymaniyah governorate and other governorates in the KRI, as it is studied for beekeepers in Sulaymaniyah governorates (Sirwan et al., 2019).

Table 1: The annual growth rate and change in the human population, broiler chicken meat production and imports between (2011-2020) in Sulaymaniyah

Year	Human population	Locally produced chicken meat (tonne)	Imported frozen chicken meat (tonne)	Imported processed chicken meat (tonne)	Total chicken meat (tonne)
2011	1,906,976	1,669.77	10,625.91	538.91	12,834.59
2012	1,964,186	3,407.32	10,195.41	1,724.73	15,327.46
2013	2,023,111	7,920.54	11,210.90	280.33	19,411.77
2014	2,083,040	14,880.19	9,311.47	359.45	24,551.11
2015	2,146,708	20,034.06	7,077.72	330.67	27,442.45
2016	2,211,109	11,802.36	5,160.75	141.22	17,104.33
2017	2,277,442	14,905.68	5,111.00	62.30	20,078.98
2018	2,345,765	15,757.73	3,662.11	126.45	19,546.29
2019	2416138	23,816.13	3,856.29	362.65	28,035.08
2020	2,488,622	11,352.23	1,092.50	841.85	13,286.57
Change %	30.50	579.87	-89.72	56.21	3.52
AAGR	2.99	32.37	-37.68	-51.69	-6.70

Data Source: KRSO and GDVS

Table 2: Poultry production annual growth in Sulaymaniyah governorate (2011-2020)

Year	Registered poultry projects	Halls	Project capacity	Introduced chicks	Survived broiler chickens
2011	315	452	4,019,059	1,003,535	725,989
2012	356	476	4,453,475	3,255,558	1,419,717
2013	411	532	5,121,875	6,799,210	3,300,228
2014	461	592	5,828,475	9,725,956	5,789,959
2015	489	629	6,277,825	11,966,764	8,045,807
2016	491	637	6,573,505	5,789,959	4,739,906
2017	518	668	7,074,955	9,441,965	5,845,363
2018	563	723	7,610,805	1,237,902	6,511,458
2019	610	782	9,413,155	18,507,410	12,601,127
2020	640	893	10,045,955	10,548,430	7,189,503
Change %	103.17	97.57	149.96	951.13	890.3
AAGR %	8.92	7.93	10.85	49.82	42.96

Data Source: KRSO and GDVS

Table 3: Average carcass weight of locally produced broiler chicken in Sulaymaniyah governorate

Year	Average chicken carcass weight (Kg)
2011	2.30
2012	2.40
2013	2.40
2014	2.57
2015	2.49
2016	2.49
2017	2.55
2018	2.42
2019	1.89
2020	1.58

Data Source: GDVS

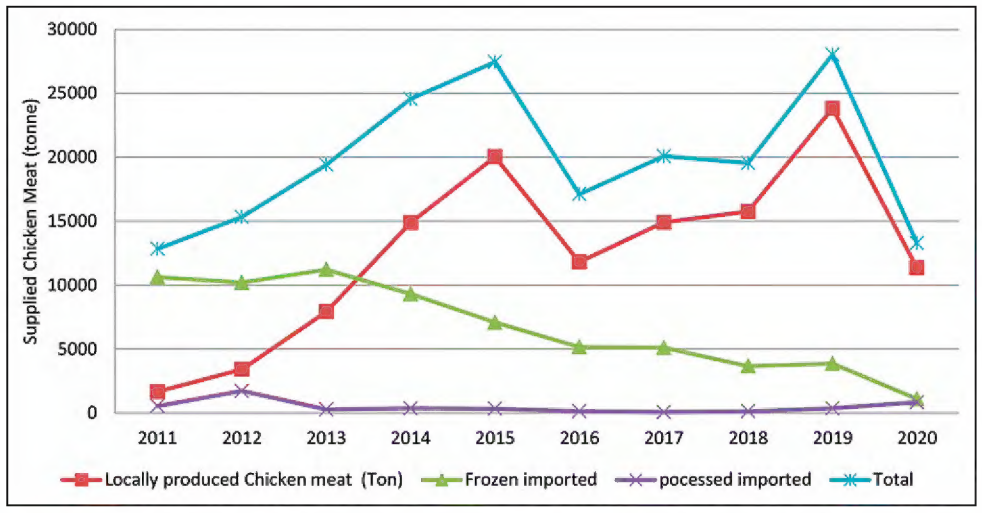

Fig 2. Trends of chicken meat supply in Sulaymaniyah governorate.

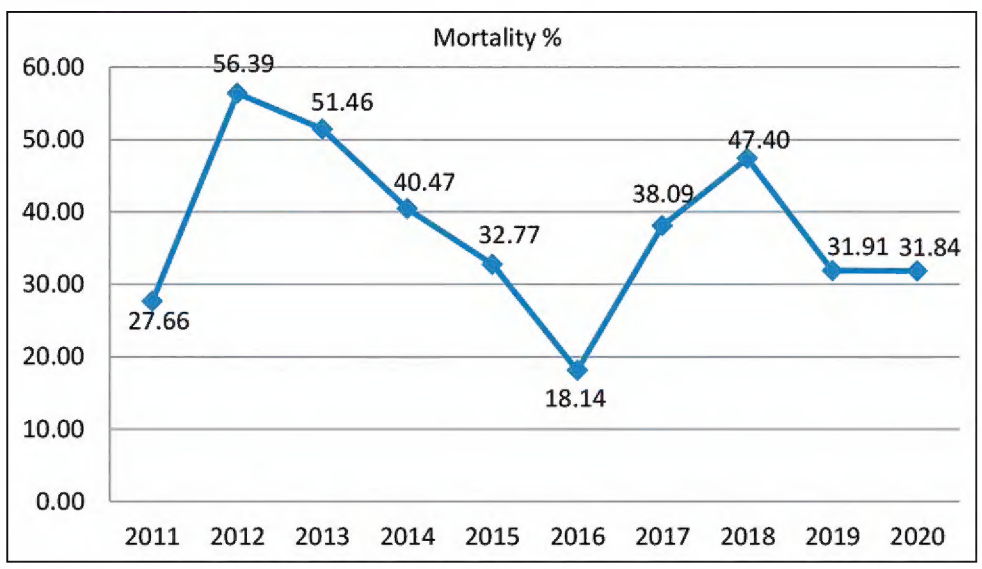

Fig 3. The mortality rate of broiler chickens.

Table 3 presents the average weight distribution of the broiler chicken carcass during (2011 - 2020). The locally produced broiler chicken carcass weights were ranged from 1.58 to 2.57 kg during the last decade (2011 – 2020) in Sulaymaniyah governorate. Overall, the average carcass weight was limited to about 2.5 Kg between 2011 to 2018 but then in the last two years, smaller broiler chickens with an average weight of 1.89 kg in 2019 and 1.58 kg in 2020 were produced which may be related to consumer demand and preference as Neima et al., (2021) found that 50% of their respondents had preference for 2-3 Kg weighted whole chicken carcass in Sulaymaniyah.

Per capita broiler chicken meat consumption

As shown in Fig. 4 per capita broiler chicken meat consumption has raised from 6.73 kg in 2011 to 11.60 kg in 2019 but dropped back to 5.33 kg in 2020 with an average annual growth rate of 3.03. These data show sharp growth in chicken meat consumption from (6.73 kg) in 2011 to (12.78 kg) in 2015 then declined to (8.33 kg) in 2018 and then a sudden up and down happened from (11.60 kg) to (5.33 kg) between 2019 and 2020 due to the recent pandemic beside domestic crisis. Per capita (kg/year) supplies from locally produced are grown with an AAGR of 34.86 while the AAGR of imported chicken meat was -16.98 between 2011 to 2020. Similarly, per capita consumption of red meat in the Sulaymaniyah governorate between 2011 to 2018 has climbed up from 4.9 kg in 2011 to 14.9 in 2014, then in 2018 it dropped to 11.8 kg (Neima and Hassan, 2020). These fluctuations are mostly linked to the per capita income in the Kurdistan region and an increase in the price of meat, as it was previously proven that income has an excessive influence on the demand for meat (Abdallaa et al., 2021; Thornton, 2010; Akbay and Boz, 2005).

In comparison to global average chicken meat consumption per capita 15.1 kg/year (Iraq 9.6, Iran 27.2, Turkey 20 Saudi Arabia 44.6 Jordan 26.7 and Kuwait 46.7) and the neighboring countries such as Turkey (16.1 kg/year), Iran (22.5 kg/year), and Saudi Arabia (43.5 kg/year) (OECD/FAO, 2018; Knoema, 2016), the per capita consumption of meat in the Sulaymaniyah governorate remains low. From the data from this study, it is highly recommended to improve the meat production sector so that production is increased as long as the per capita consumption is predicted to further increase within per capita income increase.

Broiler chicken meat self-sufficiency ratio

The self-sufficiency ratio of chicken meat production is measured as the local broiler chicken production to the total supply ratio. Fig. 5 indicate the Sulaymaniyah governorate self-sufficiency ratios of broiler chicken meat production which dramatically increased from 13.01% in 2011 to 85.44% in 2020 despite the fluctuations in local broiler chicken production as explained before.

These major up and down in the trends of chicken meat production in the Sulaymaniyah governorate can be associated with some major obstacles in the KRI and Iraq, such as the purchasing power of people (PPP), demand and preference for poultry products, mismanagement, lack of energy, lack of advanced technologies, lack of skills workers, uncertainty in supply chain management, the internal and external political instability; economic and financial crisis, exchange rate and price instability, the climate change, population growth, and corruption and the

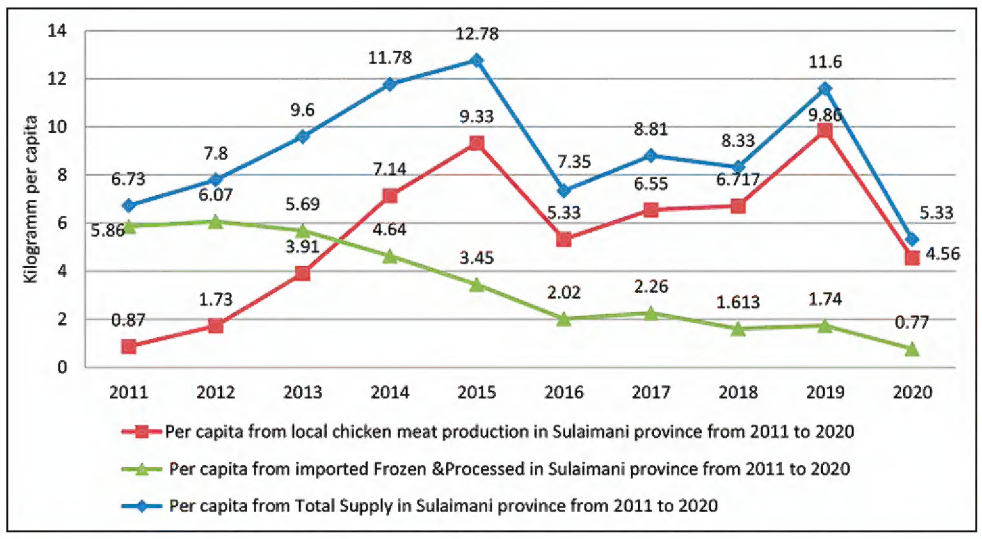

Fig 4. Local broiler chicken meat production, imports, and total supply per capita (kg/year) between (2011 to 2020).

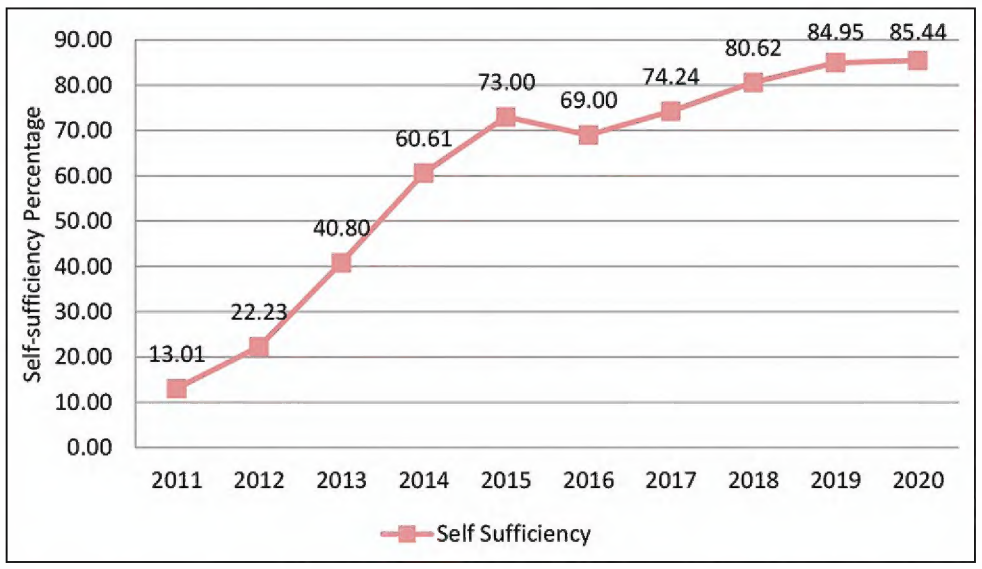

Fig 5. Broiler chicken meat production self-sufficiency in the Sulaymaniyah governorate.

contraband trading activities. That brings the necessity of scientific research to provide further data and data-based forecasts to overcome these constraints and further tight risk management (National Research Council, 2015).

Based on these data, it is forecasted estimates (as calculated in Microsoft Excel 2019) that the local broiler chicken production will be doubled by 191.77% in 2030 and the self-sufficiency rate will reach 94.39% while the predicted per capita chicken meat consumption will only increase to 8.08 kg/year. another scenario is, the per capita consumption is predicted to be more than doubled (16 – 20 kg/year) within the economic growth in the area and get close to the neighbour countries such as Turkey (16.1 kg/year), and Iran (22.5 kg/year), as a significant increase had seen between 2011 to 2015 (Fig. 4). Thus, the KRG should sustainability develop chicken meat production in KRI to fill the local market needs and have a surplus to export to other cities in Iraq, which mainly depends on imports.

CONCLUSION

In this study, it was found that local broiler chicken farm and their capacities have grown at a fast rate as the human population growth between 2011 and 2020 in the Sulaymaniyah governorate. Meanwhile, the quantity of chicken meat per capita consumption and broiler chicken production has relatively increased. Per capita consumption of chicken meat annually varied among the different types of supplied chicken meat in the Sulaymaniyah markets and the consumers mostly preferred locally produced chicken rather than imported frozen and processed chicken meat which lead to a decline in imports between 2011 and 2020. We believe that national security, economic growth, PPP, and climate were the major determinants resulting in the fluctuations in chicken meat production and consumption. The broiler chicken meat production still has not met the consumption demand in Sulaymaniyah governorate which had led to the import continuality frozen chicken meat from abroad to fill the demand gap rather than diversity and competitiveness. Further fluctuation and high mortality rates may cause destructing the sustainability of this sector in the Sulaymaniyah governorate and the KRI. The growth of demand for poultry products should be considered an important opportunity for their economic growth. The Sulaymaniyah governorate has tolerable natural resources and economic potentialities that can be used to the greatest advantage to achieve self-sufficiency in meat production and future prosperity.

CONFLICT OF INTEREST

The authors of this research paper declare that they do not have any conflict of interest.

DECLARATION OF FUNDING

This research did not receive any specific funding.

Authors' contributions

Hemin Abubakir Neima analyzed the collected data and wrote the draft of the manuscript draft. Khasraw Muheddin Hassan idealized the work. Kawan Sirwan and Khansa Hameed contributed in idealizing the work and helping the first author. In the end, all four authors revised and approved the final manuscript.

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